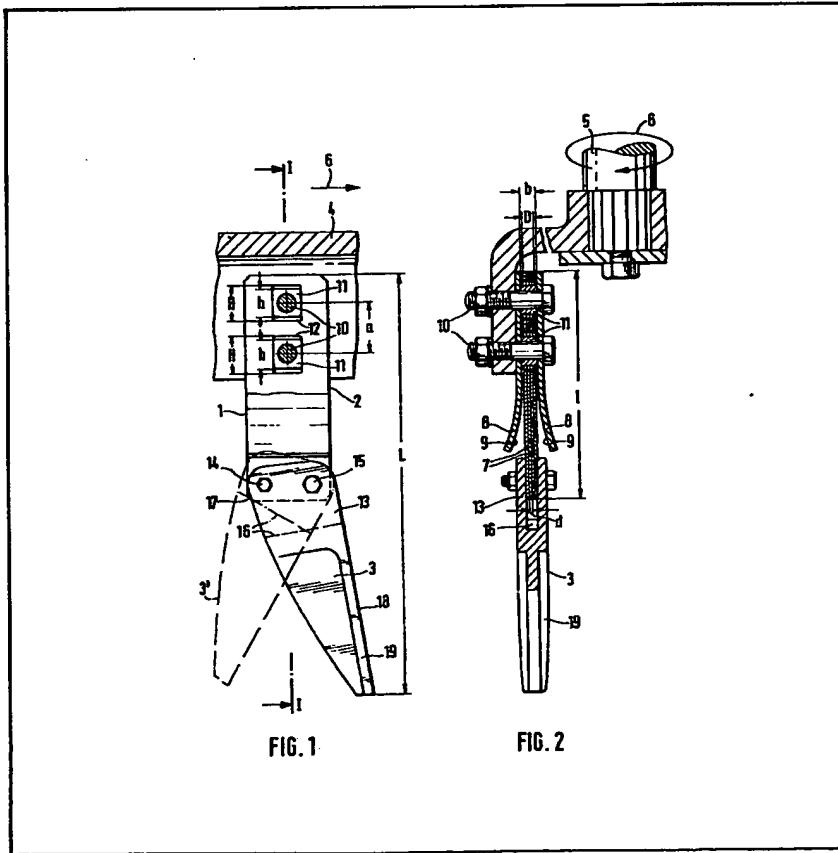


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(54) Soil cultivating machine

(57) A soil cultivating machine has a rotatable tool carrier having at least one tine (1) mounted thereon directed towards the soil, being arranged with lateral spacing from the driving shaft (5) and comprising an upper resilient mounting member (2) and a lower rigid working member (3), with its mounting member (2) having a cross-section elongated in the direction of rotation (6) of the tool carrier (4) and comprising leaf springs (7), and the working member (3) extending over at least approximately half the length (L) of the tine (1).



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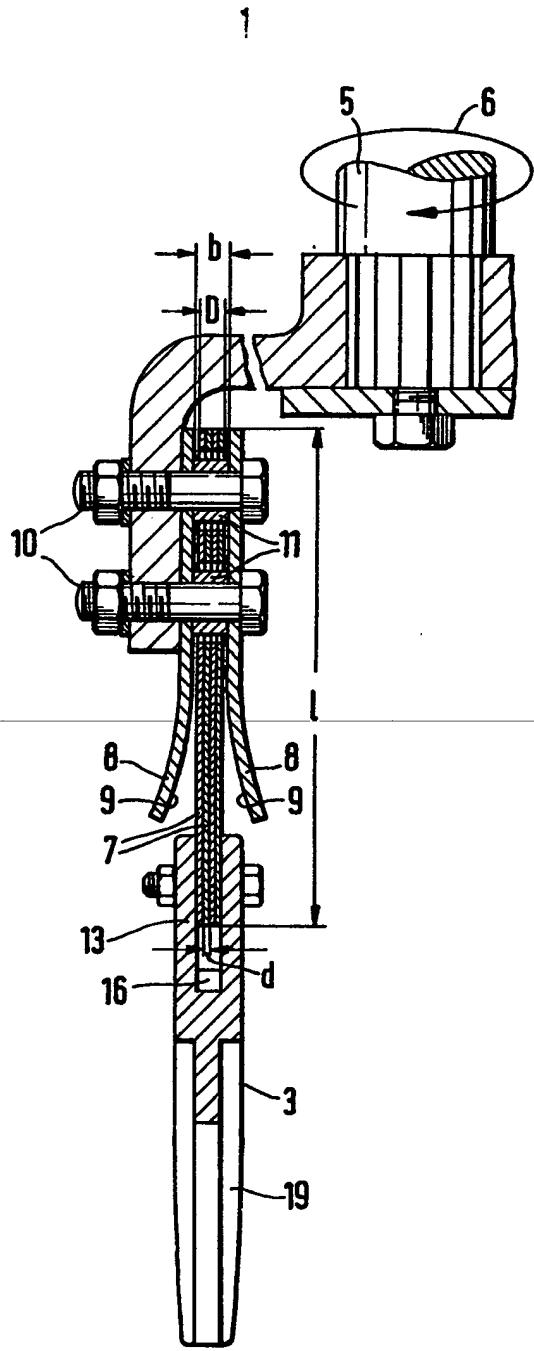
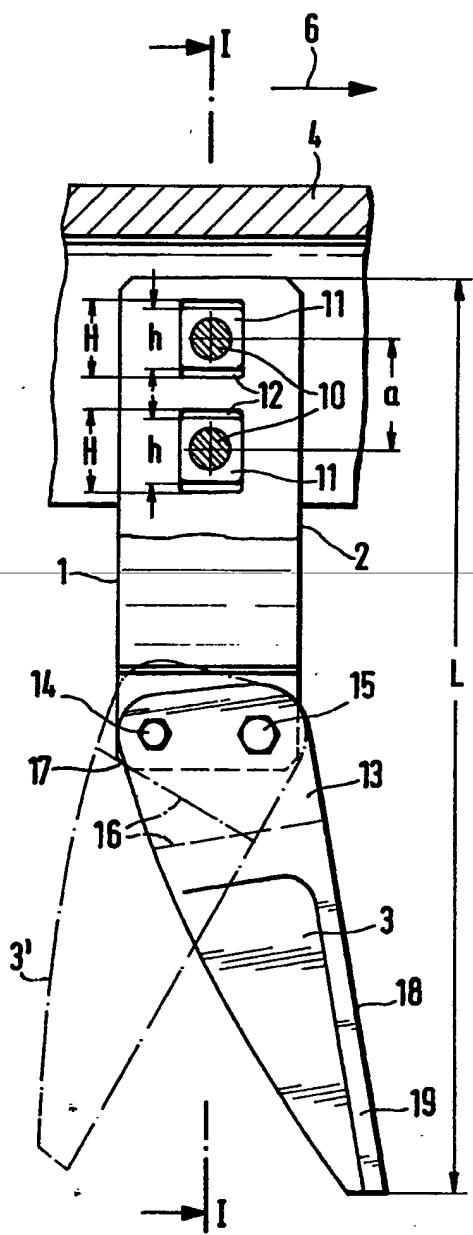


FIG. 1

FIG. 2

SPECIFICATION**Soil cultivating machine**

5 The present invention concerns a soil cultivating machine including at least one rotating tool carrier having at least one cultivating tine extending towards the soil, said tine comprising an upper resilient mounting member and a lower rigid working member and is arranged with a lateral spacing from the driving shaft.

German Offenlegungsschrift 27 55 001 discloses a soil cultivating machine wherein the resilient mounting member mentioned above has a square cross-section and extends from its upper clamping point on the tool carrier across two turns or convolutions to the centre of the rigid working member, the length of this working member amounting to approximately 1/5 of the length of the mounting member, without taking the convolutions into consideration.

Although this construction gives the advantage that each cultivating tine and particularly its mounting member can itself resiliently deform when striking against stones in the soil and thus enable the working member to slide past the stone without breakage or other damage to the cultivating tines themselves or to parts connected therewith. However, it is a disadvantage that the mounting member is already bent backwardly against the direction of rotation of the tool carrier with adjustment to greater, and, in many cases, necessary working depths – particularly in the case of heavy soils and/or soils impregnated with small stones, due to the greater resistance of the soil. In these cases, however, there is such a change in the angle of incidence of the working member relative to the soil that the intended loosening work by the cultivating machine is no longer obtained.

Hence the object of the present invention is to avoid or minimize damage to the cultivating tine or tines at comparatively great working depths and in extremely stony soils without restricting the particular loosening work of the soil cultivating machine.

This object is achieved in accordance with the present invention in that of the originally described machine or implement the mounting member has cross-section elongate in the direction of rotation of the tool carrier, and that the working member extends over at least approximately half the length of the tine. Due to these features the working member is able to deflect laterally and thus avoid the stones in the soil without changing its angle of incidence relative to the soil. In addition, only the working part and not the mounting member thereby comes into contact with stones in the soil.

The possibility of resilient deflection of the working member is further increased in that the mounting member comprises a plurality of leaf springs in contact with each other by their wide surfaces. In this connection it has proved to be advantageous for the thickness of each leaf spring to be not more than a maximum of 3 mm.

In order to prevent deflection leading to excessive and, in extreme cases, permanent deformations of the mounting member, the invention also provides

that a limiting member rigidly secured to the tool carrier should be provided on both wide surfaces or sides of the mounting member and that these limiting members should extend downwardly over at least half the length of the mounting member. In view of the lateral resilient deformation of the mounting member, it is a great advantage for the inner surfaces of the limiting members to extend diverging downwardly according to the bending line

75 of the mounting member. If the limiting members are formed as a downwardly open housing, a particularly stable construction of the mounting member is achieved without restricting the possibility of the working member to deflect.

80 On the other hand, due to the fact that the limiting members are in the form of plates, comprise resilient material and have a much greater elasticity or spring constant than the mounting member, a greater possibility of deflection for the working member is

85 achieved without the risk of constant deformation of said mounting member.

A simple mode of construction of the tool carrier is obtained by the mounting member being secured to the limiting members. If, in order to secure the mounting member to the limiting members, two spaced apart screws are provided which pass through both the limiting members and the mounting member and spacer bushes are disposed between the limiting members and the screws – the

95 length of said bushes being greater than the thickness of the mounting member – then an additional lateral movement of the mounting member is provided within the limiting member for further increasing the possibility of deflection.

100 An additional improvement of the possibility of deflection for the working member is achieved when the spacer bushes and the holes provided for them in the mounting member have a quadrangular shape, the height of the holes in the longitudinal direction of the mounting member being greater than the height of the spacer bushes. As a result of these features, the individual leaf springs are able to be relatively displaced in their longitudinal direction in the event of a lateral resilient deflection of the mounting member, so that only a pure bending stress is possible for them and not, in addition, traction or pressure stresses in their longitudinal direction. In order to avoid additional securing members for the limiting members, said limiting members are mounted

110 on the tool carrier by means of the two screws for securing the mounting member. Despite this possibility of displacement for the leaf springs relatively to each other, a secure mount of the entire tine is achieved by the feature that both screws are disposed one above the other.

In order to prevent damage to the tine, an additional feature according to the present invention provides for the working member to be mounted on the mounting member by means of two securing members – one of which has a smaller cross-section than the other securing member and is provided as a safety member against breakage (in the manner of a shear pin). By this means if the possibility of deflection for the mounting member should no longer suffice for avoidance of a comparatively large stone

then the working member itself can then pass also over the stone in the soil. An additional advantage is obtained in this case by the feature that a stop is provided which, after breakage or removal of the securing member provided as anti-breakage member for the implement, keeps the working member in a position inclined backwardly relatively to the direction of rotation of the tool carrier. As a result of these features, after the shearing-off of the anti-breakage member, the working member assumes the favourable position inclined backwardly for sliding over the stone. In addition, this position can be adjusted in advance by removing the securing member provided as anti-breakage member. This effects an even better crumbling work which is preferable for producing a finished seed bed from an already ploughed field.

In a simple embodiment of the invention the mounting member projects into a bifurcated attachment portion of the working member, whilst the securing member provided as anti-breakage element is disposed behind the other securing element viewed in the direction of rotation of the tool carrier. In addition taking into consideration the above-mentioned proposed use, a further simplification of the construction of the tine is achieved in that as a stop, the rear part of the lower end of the mounting member, viewed in the direction of rotation of the tool carrier, is provided for the contact of the lower surface of the bifurcated attachment portion.

Finally, the invention proposes that the working member should have a reinforcement extending along the front edge of the working member with its wide side transverse to the direction of rotation – viewed in the direction of rotation of the tool carrier. This feature has proved to be favourable for solving the problem of creation notches on the front edges of the tine which are avoided to a very considerable extent when these edges come into contact with stones.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a tine; and
 Fig. 2 is a section taken on the line I-I.

A downwardly directed tine 1 comprises an upper resilient mounting member 2 and a lower rigid working member 3 and is disposed on the inside of a tool carrier 4 which is shown as a cut-out section. The carrier 4 is non-rotatably connected to the driving shaft 5 and is rotatable therewith in the direction shown by the arrow 6. The mounting member 2 has a cross-section elongated in the direction of rotation 6 and four leaf springs 7 in contact with each other at their wide side surfaces, whilst the working member 3 extends over somewhat more than half the length L of the tine 1. The leaf springs 7 each have a thickness d of 2 mm. Plate-like limiting members 8 are provided on either side of the broad sides of the mounting member 2 and extend downwardly over half the length l of the mounting member 2 and are made of resilient material having a much greater spring constant than the mounting member 2. In addition, the inner surfaces 9 of the limiting members 8 diverge downwardly according to the line of

fixing of the mounting member 2.

Two screws 10 are provided for the attachment of the mounting member 2 and the limiting members 8 to the tool carrier 4 and the screws are disposed on above the other with a spacing a. Spacing bushes 11 are disposed on the screws 10 and between the limiting members 8, and the length b of the bushes is greater than the thickness D of the resilient mounting member 2. In addition, the spacing bushes 11 and holes 12 provided for them in the mounting member 2 have a quadrangular shape, whilst the height H of the holes 12 extending in the longitudinal direction of the mounting member 2 is greater than the height h of the spacer bushes 11.

80 The working member 3 is provided at its upper end with a bifurcated attachment portion 13 into which the lower end of the mounting member 2 extends. For securing the working member 3 to the resilient mounting member 2, two screw or helical securing members 14 and 15 are provided, of which, viewed in the direction of rotation 6, the rear member 14 has a smaller cross-section and serves as an anti-breakage element or shear pin or member. In the event of shearing or after the removal of this securing element 14, the working member 3 swivels backwardly about the front securing element 15 to such an extent until the lower surface 16 of the bifurcated attachment 13 is in contact with stop 17 formed by the rear portion of the lower end of the mounting member 2 and assumes the position 3' indicated in broken lines.

Finally, the working member 3 is provided with a reinforcement 19 along its front edge, viewed in the direction of rotation 6, and reinforcement 9 extends with its wide side transverse to the direction of rotation 6.

The present invention also relates to a soil cultivating implement having a rotatable tool carrier supporting at least one cultivating tine extending therefrom and to component parts thereof.

CLAIMS

1. A soil cultivating machine having at least one rotatable tool carrier having at least one tine mounted thereon and directed towards the soil, said tine being arranged with lateral spacing from the driving shaft and comprising an upper resilient mounting member and a lower rigid working member, with said mounting member having a cross-section elongated in the direction of rotation of the tool carrier, said working member extending over at least approximately half the length (L) of the tine.
2. A machine as claimed in claim 1, characterised in that the mounting member comprises a plurality of leaf springs in contact with each other by their wide sides.
3. A machine as claimed in claim 2, characterised in that the thickness (d) of each leaf spring amounts to a maximum of 3mm.
4. A machine as claimed in any of claims 1 to 3, in which both broad sides of the mounting member are each provided with a limiting member rigidly secured to the tool carrier, and in which these limiting members extend downwardly over at least half the length of the mounting member.

5. A machine as claimed in claim 4, in which the inner surfaces of the limiting members diverge inwardly according to the bending line of the mounting member.
- 5 6. A machine as claimed in claim 4 or 5, in which the limiting members are formed as a housing which is open at the bottom.
7. A machine as claimed in claim 4 or 5, in which the limiting members are formed as plates of resilient material and have a considerably greater spring constant than the mounting member.
- 10 8. A machine as claimed in any of claims 4 to 7, in which the mounting member is secured to the limiting members.
- 15 9. A machine as claimed in claim 8, in which the mounting member is secured to the limiting members by two screws which are spaced apart by a distance (a) and both extend through the limiting members and through the mounting member, and in which spacing bushes are disposed on the screws between the limiting members and the length (b) of said bushes is greater than the thickness (D) of the mounting member.
- 20 10. A cultivating machine as claimed in claims 8 and 9, in which the spacing bushes and the respective holes provided for them in the mounting member are quadrangular, the height (H) of the holes extending in the longitudinal direction of the mounting member being greater than the height (h) of the spacing bushes.
- 25 11. A machine as claimed in claims 8 to 10, in which the limiting members are mounted on the tool carrier by means of the two screws for securing the mounting member.
- 30 35 12. A machine as claimed in claims 8 to 11, in which the two screws are disposed one above the other.
- 40 13. A machine as claimed in any of claims 1 to 12, in which the working member is located on the mounting member by means of two securing members, one securing member having a smaller cross-section than the other securing member and being provided as a safety member or shear means as protection against breakage.
- 45 14. A machine as claimed in claim 13, in which a stop is provided which, after breakage or removal of the securing member provided as safety member against breakage restrains the working member in a position inclined backwardly to the direction of rotation of the tool carrier.
- 50 15. A machine as claimed in claims 13 and 14, in which the mounting member merges into a bifurcated extension of the working member, and in which the securing member, provided as safety member against breakage, is disposed behind the other securing member viewed in the direction of rotation of the tool carrier.
- 55 16. A machine as claimed in claims 13 to 15, in which the rear portion of the lower end of the mounting member, viewed in the direction of rotation of the tool carrier, is provided as an abutment for contact with the lower surface of the bifurcated extension.
- 60 17. A machine as claimed in any of claims 1 to 16, in which the working member is provided along its front edge, viewed in the direction of rotation of the tool carrier, with a reinforcement extending with its wide end transverse to the direction of rotation.
- 65 18. A soil cultivating implement constructed and arranged to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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